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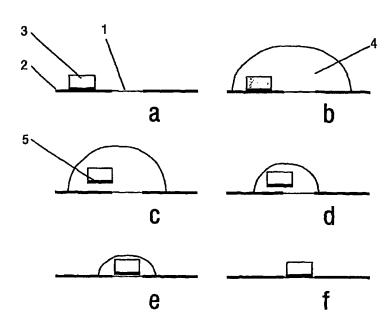
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[Continued on next page]

(54) Title: MANIPULATION OF MICROMETER-SIZED ELECTRONIC OBJECTS WITH LIQUID DROPLETS



(57) Abstract: A system for manipulating a small object (3) comprising a substrate to receive the small object (3), a liquid droplet (4), which carries the small object (3) on the substrate, and a pre-treated surface structure of the substrate in the vicinity (1,2) of the placement position (1) of the small object (3). The small objects (3) like silicon dies in the range from 100 down to 1 micrometer are fine-placed by an evaporating droplet (4). The dies will serve as active electronic elements in large-area displays and other applications.



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SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK,

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A. CLASSIFICATION OF SUBJECT MATTER IPC 7 H01L21/98

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B. FIELDS SEARCHED

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Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT							
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.					
X	JIE LIU ET AL: "Controlled deposition of individual single-walled carbon nanotubes on chemically functionalized templates" CHEMICAL PHYSICS LETTERS ELSEVIER NETHERLANDS, vol. 303, no. 1-2, 2 April 1999 (1999-04-02), pages 125-129, XP002319483 ISSN: 0009-2614 the whole document	1,2					
Y	GB 2 373 095 A (* SEIKO EPSON CORPORATION) 11 September 2002 (2002-09-11) paragraph '0030! -/	3					

X Further documents are listed in the continuation of box C.	X Patent family members are listed in annex.
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International Application No PCT/IB 03/05273

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	ation) DOCUMENTS CONSIDERED TO BE RELEVANT	
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	NAGAHARA L A ET AL: "Directed placement of suspended carbon nanotubes for nanometer-scale assembly" APPLIED PHYSICS LETTERS AIP USA, vol. 80, no. 20, 20 May 2002 (2002-05-20), pages 3826-3828, XP002319484 ISSN: 0003-6951 the whole document	1,2
A	US 6 294 063 B1 (BECKER FREDERICK F ET AL) 25 September 2001 (2001-09-25) cited in the application the whole document	
P,X	US 2003/190278 A1 (WANG YAN MEI ET AL) 9 October 2003 (2003-10-09) paragraph '0010!	1,6
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		}

INTERNATIONAL SEARCH REPORT

nformation on patent family members

International Application No PC-/IB 03/05273

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
GB 2373095	A	11-09-2002	CN	1462484 A	17-12-2003
			EP	1366529 A1	03-12-2003
			WO	02073712 A1	19-09-2002
			JР	2004530292 T	30-09-2004
			TW	573314 B	21-01-2004
			US	2004029382 A1	12-02-2004
US 6294063	B1	25-09-2001	AT	266472 T	15-05-2004
			CA	2362114 A1	17-08-2000
			DE	60010666 D1	17-06-2004
			DK	1154856 T3	02-08-2004
			EP	1154856 A2	21-11-2001
			EP	1464400 A1	06-10-2004
			JР	2002536167 T	29-10-2002
			WO	0047322 A2	17-08-2000
			US	2002036139 A1	28-03-2002
US 2003190278	A1	09-10-2003	NONE		